UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/748,631	12/30/2003	Alex Nugent	1000-1216	7487

7590 11/02/2006

Ortiz & Lopez, PLLC
Patent Attorneys
P.O. Box 4484
Albuquerque, NM 87196-4484

EXAMINER	
TRAN, MAI T	

ART UNIT	PAPER NUMBER
2129	

DATE MAILED: 11/02/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/748,631	NUGENT, ALEX	
	Examiner	Art Unit	
	Mai T. Tran	2129	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 August 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

REMARKS

Applicant's amendment dated August 14, 2006 responding to the June 29, 2006 Office Action provided in the rejection of claims 1-20, wherein claims 1, 11, 15-18 have been amended. Claims 1-20 remain pending in the application and which have been fully considered by the examiner.

The Examiner withdraws the objection to the specification for the minor informalities corresponding to Applicant's amendment.

INFORMATION DISCLOSURE STATEMENT

1. The information disclosure statement filed August 14, 2006 fails to comply with 37 CFR 1.98(a)(1), which requires the following: (1) a list of all patents, publications, applications, or other information submitted for consideration by the Office; (2) U.S. patents and U.S. patent application publications listed in a section separately from citations of other documents; (3) the application number of the application in which the information disclosure statement is being submitted on each page of the list; (4) a column that provides a blank space next to each document to be considered, for the examiner's initials; and (5) a heading that clearly indicates that the list is an information disclosure statement. The information disclosure statement has been placed in the application file, but the information referred to therein has not been considered.

2. The information disclosure statement filed **January 29, 2004** fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

- Page 1 of 7: the document number 6,282,530 does not have the correct date. Therefore, the Examiner does not know which patent applicant is intended to list.
- Page 2 of 7: the document number EP 1 069 206 A2 does not have the correct date. Therefore, the Examiner does not know which patent applicant is intended to list.
- Page 3 of 7:
  - ❖ the other prior art "Nanotubes for Electronics", page 69 is missing.
  - ❖ the other prior art "Aligning single-wall carbon nanotubes with an alternating-current electric field" is missing.
- Page 4 of 7: the other prior art "Purification of Single Wall Carbon Nanotubes by Microfiltration", page 8842 is missing.
- Page 5 of 7:
  - ❖ the other prior art "Evolution of Avalanche Conducting States in Electrorheological Liquids" is duplicate with item # 2 on page 4 of 7.
  - ❖ the other prior art "Rapid Communication Orientation and Purification of Carbon Nanotubes Using AC Electrophoresis" is missing.

- Page 7 of 7: the other prior art "Building blocks for electronic spiking neural networks" is duplicate with the last item on this page.

3. The information disclosure statement filed **October 7, 2005** fails to comply with 37 CFR 1.98(a)(2), which requires a legible copy of each cited foreign patent document; each non-patent literature publication or that portion which caused it to be listed; and all other information or that portion which caused it to be listed. It has been placed in the application file, but the information referred to therein has not been considered.

- the other prior art "Nanoparticles Get Wired" is missing.

CLAIM REJECTIONS - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims **1-7, 9-11, and 13-20** are rejected under 35 U.S.C. 102(b) as being anticipated by "Solid-state thin-film memistor for electronic neural networks", by Thakoor et al, hereafter Thakoor.

Claim 1

Thakoor teaches a system, comprising:

a physical neural network configured utilizing nanotechnology (title), wherein said physical neural network comprises a plurality of nanoconductors suspended and free to move

about in a dielectric medium (page 3132, right column, lines 10-12, page 3133, right column, lines 3-5) and which form neural connections between pre-synaptic and post-synaptic components of said physical neural network (page 3132, left column, lines 24-41); and

a learning mechanism for applying Hebbian learning to said physical neural network (page 3133, left column, lines 1-14).

Claim 2

Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes a voltage gradient to implement Hebbian plasticity within said physical neural network (Figure 2).

Claim 3

Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes voltage gradient dependencies associated with physical neural network to implement Hebbian learning within said physical neural network (Figure 2).

Claim 4

Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes pre-synaptic and post-synaptic frequencies to provide Hebbian learning within said physical neural network (page 3132, left column, lines 24-41, page 3133, left column, lines 1-14).

Claim 5

Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes a voltage gradient to implement anti-Hebbian plasticity within said physical neural network (Figure 2).

Claim 6

Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes voltage gradient dependencies associated with physical neural network to implement anti-Hebbian learning within said physical neural network (Figure 2).

Claim 7

Thakoor teaches the system of claim 1 wherein said learning mechanism utilizes pre-synaptic and post-synaptic frequencies to provide anti-Hebbian learning within said physical neural network (page 3132, left column, lines 24-41, page 3133, left column, lines 1-14).

Claim 9

Thakoor teaches the system of claim 1 wherein said plurality of nanoconductors includes nanoconductors comprising nanowires (page 3133, left column, lines 4-5).

Claim 10

Thakoor teaches the system of claim 1 wherein said plurality of nanoconductors includes nanoconductors comprising nanoparticles (page 3133, left column, lines 4-5).

Claim 11

Thakoor teaches a system, comprising:

a physical neural network configured utilizing nanotechnology (title), wherein said physical neural network comprises a plurality of nanoconductors suspended and free to move about in a dielectric medium (page 3132, right column, lines 10-12, page 3133, right column, lines 3-5) and which form neural connections between pre-synaptic and post-synaptic components of said physical neural network (page 3132, left column, lines 24-41); and

a learning mechanism for applying Hebbian learning to said physical neural network wherein said learning mechanism utilizes a voltage gradient or pre-synaptic and post-synaptic frequencies thereof to implement Hebbian or anti-Hebbian plasticity within said physical neural network (page 3133, left column, lines 1-14).

Claim 13

Thakoor teaches the system of claim 11 wherein said plurality of nanoconductors includes nanoconductors comprising nanowires (page 3133, left column, lines 4-5).

Claim 14

Thakoor teaches the system of claim 11 wherein said plurality of nanoconductors includes nanoconductors comprising nanoparticles (page 3133, left column, lines 4-5).

Claim 15

Thakoor teaches the system of claim 11 wherein said dielectric medium comprises a dielectric liquid (page 3132, right column, lines 10-12, page 3133, right column, lines 3-5).

Claim 16

Thakoor teaches the system of claim 15 wherein said plurality of nanoconductors form physical neural connections when said dielectric medium is exposed to an electric field, such that said physical neural connections can be strengthened or weakened depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof (page 3133, left column, lines 1-14).

Claim 17

Thakoor teaches a system, comprising:

a plurality of molecular conductors disposed in and free to move about within a dielectric medium comprising a dielectric solvent or a dielectric solution (page 3132, right column, lines 10-12, page 3133, right column, lines 3-5);

at least one input electrode in contact with said dielectric medium (page 3133, left column, lines 1-14); and

at least one output electrode in contact with said dielectric medium, wherein said plurality of molecular conductors form physical neural connections when said dielectric medium is exposed an electric field across said at least one input electrode and said at least one output electrode, such that said physical neural connections can be strengthened or weakened depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof (page 3132, left column, lines 24-41, page 3133, left column, lines 1-14).

Claim 18

Thakoor teaches the system of claim 17 further comprising a physical neural network comprising said plurality of molecular conductors disposed within a dielectric medium comprising a dielectric solvent or a dielectric solution (page 3132, right column, lines 10-12), said at least one input electrode in contact with said dielectric medium, and said at least one output electrode in contact with said dielectric medium (page 3133, left column, lines 1-14).

Claim 19

Thakoor teaches the system of claim 18 further comprising a learning mechanism for applying Hebbian learning to said physical neural network wherein said learning mechanism utilizes a voltage gradient or pre-synaptic and post-synaptic frequencies thereof to implement Hebbian or anti-Hebbian plasticity within said physical neural network (Figure 2).

Claim 20

Thakoor teaches the system of claim 18 wherein said physical neural network is configured as an integrated circuit chip utilizing nanotechnology (Figure 3).

CLAIM REJECTIONS - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claims **8 and 12** are rejected under 35 U.S.C. 103(a) as being unpatentable over Thakoor as applied to claims 1-7, 9-11, and 13-20 above, and further in view of "Computational Nanotechnology with Carbon Nanotubes and Fullerenes", by Deepak Srivastava et al, hereafter Srivastava.

Thakoor teaches a physical neural network configured utilizing nanotechnology wherein said physical neural network comprises a plurality of nanoconductors but fails to disclose said plurality of nanoconductors includes nanoconductors comprising nanotubes.

Srivastava teaches computational nanotechnology with carbon nanotubes and fullerenes (title).

It would have been obvious at the time the invention was made to a person having ordinary skill in the art to combine the physical neural network utilizing nanotechnology of Thakoor with the carbon nanotubes of Srivastava. The motivation for doing so would be to perform complex computing and switching applications in a single pass and also, the signals propagated, branched, and switched on such a network need not be restricted to the "electronic" regime (page 52, left column, lines 3-11).

RESPONSE TO ARGUMENTS

Applicant's arguments filed August 14, 2006 have been fully considered but they are not persuasive. Specifically, Applicant makes the following arguments:

1. Rejection of claims 1-7, 9-11, and 13-20 under 35 U.S.C. § 102

Applicant's arguments filed August 14, 2006 have been considered, however, Examiner finds them unpersuasive. Specifically:

Argument 1

Requirements; for Prima Facie Anticipation

A general definition of prima facie unpatentability is provided at 37 C.F.R. §1.56(b)(2)(ii):

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration Is given to evidence which may be submitted In an attempt: to establish a contrary conclusion of patentability. (emphasis added)

> *"Anticipation requires the disclosure in a single prior art reference of each element of the claim under consideration." W.L. Gone & Associates v. Garlock, Inc., 721 F.2d 1540, 220 USPQ 303, 313 (Fed. Cir. 1983) (citing Soundscriber Corp. v. United States, 360 F.2d 954, 960, 148 USPQ 298, 301 (Ct. Cl.), adopted, 149 USPQ 640 (Ct. Cl. 1966)), cert. denied, 469 U.S. 851 (1.984). Thus, to anticipate the applicants' claims, the reference cited by the Examiner must disclose each element recited therein. "There must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention." Scripps Clinic & Research Foundation v. Genentech, Inc., 927 F.2d 1565, 18 USPQ 2d 1001, 1010 (Fed. Cir. 1991).*
>
> *To overcome the anticipation rejection, the Applicant needs to only demonstrate that not all elements of a prima facie case of anticipation have been met, i.e., show that the prior art reference cited by the Examiner falls to disclose every element in each of the applicants' claims. "If the examination at the initial state does not produce a prima face case of unpatentability, then without more the applicant is entitled to grant of the patent." In re Oetiker, 977 F.2d 1443, 24 USPQ 2d 1443, 1444 (Fed. Cir. 1992).*

Applicant is correct in his case citings regarding anticipation...as far as he goes, but patent law is more comprehensive than Applicant recites here (Examiner refuses to believe that Applicant is asserting that he has enumerated an exclusive list of laws that apply with respect to §102 rejections. Patent law is more comprehensive than that). Examiner will give a few examples of laws and rules that also come into play in such circumstances. One is MPEP 2112, where anticipation may be shown by "inherency." In contrast, Applicant seems to argue that all elements in a rejection must be express in the prior art.

That is not the case. Inherency is a ground for anticipation as well. Clearly, with the omission of this law in Applicant's argument, Applicant has shown that his selections of law are overly narrow and misleading as to what is required for anticipation. In addition to MPEP 2112 as authority for "inherency" there is supporting case law in In re Napier, and In re Grasselli.

In addition to "inherency", Examiners are required to read the claims in their "broadest reasonable interpretation" under MPEP 2111. This is another principle used in conjunction with

102 rejections that weighs against Applicant's implication that all claim elements must be express in the prior art. Not all engineers use the same vocabularies for things, so one must interpret the disclosures to see if the prior art is within the "broadest reasonable interpretation" of the claimed invention.

Consequently, Applicant's recitals of law are helpful, but not exclusive of all other law that can and must be applied during examination. Examiner applied her rejections while cognizant of all this law and Applicant has not made a specific and cogent argument regarding Examiner's application of law here. Accordingly, Applicant's argument suggesting that claim limitations must be express in the prior art is unpersuasive and the rejections STAND.

Argument 2

***Regarding claim 1**: Thakoor at page 3132, left column, lines 24-41 does not make any mention of nanoconductors, nor pre-synaptic and post-synaptic components of a physical neural network. Thakoor does refer generally to "neural network architectures" and "synapses" (see page 3132, left column, lines 22-24), but does not provide for any disclosure, teaching or suggestion of nanoconductors, and pre-synaptic and post-synaptic components of a physical neural network. Thakoor only refers generally to "neural network architectures" but does not describe a physical neural network and instead teaches a "memistor" device, which is not a physical neural network as taught by Applicant's invention. The memistor device taught by Thakoor can be adapted for use with an electronic neural network as indicated by Thakoor. The Thakoor reference, however, does not actually disclose a physical neural network as taught by Applicant.*

Thakoor also does not provide any teaching anywhere of nanoconductors and pre-synaptic and post-synaptic components as taught by the Applicant's invention. The Applicant provides for a teaching of "nanoconductors," which is not taught by Thakoor. For example, the Applicant's specification at paragraph [0020] indicates the following:

> *"Integrated circuits and electrical components thereof, which can be produced at a molecular and nanometer scale, include devices such as carbon nanotubes and nanowires, which essentially are nanoscale conductors ("nanoconductors"). Nanoconductors are tiny conductive tubes (i.e. hollow) or wires (i.e. solid) with a very small size scale (e.g., 0.7 to 300 nanometers in diameter and up to 1mm in length)."*

Similarly, the Applicant's specification at paragraph [0087] indicates the following:

> *"The network of nanoconnections depicted in FIG. 3 can be implemented as a network of molecules, including, for example, nanoconductors. Examples of nanoconductors include devices such as, for example, nanowires, nanotubes, and nanoparticles."*
> *It is thus clear that such nanoconductors are not taught, disclosed or suggested by Thakoor. Additionally, the Applicant notes that the Thakoor reference does not teach, disclose or suggest a neural network based on nanoconductors disposed and free to move about within a dielectric medium.*
>
> *Additinally, column 3133, left column, lines 1-14 of Thakoor does not provide for any hint, suggestion or teaching of a learning mechanism and specifically, Hebbian learning. Instead column 3133, left column, lines 1-14 of Thakoor refers generally to H+ ions, tungsten acid and chemical processes involved in the liberation of hydrogen and measurement of resistance. It is unclear how column 3133, left column, lines 1-14 of Thakoor constitutes "Hebbian learning" as taught by Applicant's invention.*

Applicant is reminded that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In this argument, Applicant admitted Thakoor teaches "synapses" and a "memistor device". In the broadest reasonable interpretation of this art, a memistor device is interpreted as a physical neural network and pre-synaptic and post-synaptic components are inherent in synapses.

As far as Applicant's claim for "**nanoconductors**" is concerned, the prior art anticipates this feature with **H+ ions**, which are clearly measurable and verifiable to be on the nanometer scale. Applicant has not brought **evidence** to prove that H+ ions are not on the nanometer scale, as Examiner asserts.

The "nanoconductors" in Thakoor are "H+ ions" as Applicant calls them (or "H+ ions" as the prior art calls them). They are suspended in a "**thin film of hygroscopic chromium trioxide**" as the prior art calls it (or "dielectric medium" as Applicant calls it).

Regarding Applicant's claim for "**Hebbian learning**", Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put a field to adjust the memory. Such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. Hebbian learning.

Therefore, Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 3

> ***Regarding claim 2 and claim 3**, Figure 2 of Thakoor only illustrates a graph of resistance versus time (in minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not a learning mechanism, Hebbian learning and Hebbian plasticity as taught by Applicant's claim 2.*

Regarding Applicant's claim for "**Hebbian learning**", Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put a field to adjust the memory. Such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. Hebbian learning.

As far as Applicant's claim for "**Hebbian plasticity**" or "**anti-Hebbian plasticity**" is concerned, the prior art anticipates this feature in Figure 2. Figure 2 illustrates the variation in resistance with time for several different control voltages. Plasticity by definition is the ability to develop or adapt in response to the environment. Another word, the ability to learn or unlearn. As responded above regarding Hebbian learning, the growing or lessening the conductivity of the resistance put a field to adjust the memory. Therefore, the learning or unlearning is being performed.

Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 4

Regarding claim 4, neither page 3132, left column, lines 24-41 nor page 3133, left column, lines 1-14 of Thakoor provide for any disclosure, teaching and/or suggestion of "Hebbian learning". Additionally, as indicated earlier there is no disclosure in Thakoor of "pre-synaptic" and "post-synaptic" components.

Regarding Applicant's claim for "**Hebbian learning**", Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put a field to adjust the memory. Such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. Hebbian learning.

As responded earlier, Thakoor teaches "synapses" and pre-synaptic and post-synaptic components are inherent in synapses.

Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 5

Regarding claim 5 and claim 6, Figure 2 of Thakoor does not provide for any teaching of anti-Hebbian plasticity. Instead, Figure 2 of Thakoor only illustrates a graph of resistance versus time (in minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not anti-Hebbian plasticity as taught by Applicant's claim 5.

As far as Applicant's claim for "Hebbian plasticity" or "anti-Hebbian plasticity" is concerned, the prior art anticipates this feature in Figure 2. Figure 2 illustrates the variation in resistance with time for several different control voltages. Plasticity by definition is the ability to develop or adapt in response to the environment. Another word, the ability to learn or unlearn.

As responded above regarding Hebbian learning, the growing or lessening the conductivity of the resistance put a field to adjust the memory. Therefore, the learning or unlearning is being performed.

Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 6

Regarding claim 7, Thakoor at page 3132, left column, lines 24-41, and page 3133, left column, lines 1-14, does not teach anti-Hebbian learning as taught by Applicant's invention, nor a learning mechanism as taught by Applicant's invention. Additionally, Thakoor at page 3132, left column, lines 24-41, and page 3133, left column, lines 1-14, does not teach pre and post-synaptic components and nanoconductors as taught by Applicant's claim 7.

Regarding Applicant's claim for "**anti-Hebbian learning**", Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put a field to adjust the memory. Such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. anti-Hebbian learning.

As responded earlier, Thakoor teaches "synapses" and pre-synaptic and post-synaptic components are inherent in synapses.

As far as Applicant's claim for "**nanoconductors**" is concerned, the prior art anticipates this feature with **H+ ions**, which are clearly measurable and verifiable to be on the nanometer scale. Applicant has not brought **evidence** to prove that H+ ions are not on the nanometer scale, as Examiner asserts.

Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 7

Regarding claim 9 and claim 10, page 3133, left column, lines 4-5 of Thakoor does not teach, disclose or suggest "nanowires" or "nanoparticles" as taught by Applicant's claim 9 and 10. Instead, page 3133, left column, lines 4-5 of Thakoor indicates only that "the rate of formation of H_xWO_3 depends primarily on the control voltage". H_xWO_3 is a chemical compound, but not a nanowire or a nanoparticle as taguth by Applicant's claim 9 and 10.

In this argument, Applicant freely admitted that H_xWO_3 is a chemical compound. Nanowires or nanoparticles by definition, are components of nanotechnology to create electrical circuits out of chemical compounds that are capable of being formed into extremely small circuits.

Therefore, Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 8

Regarding claim 11, Thakoor at page 3132, left column, lines 24-41 does not make any mention of nanoconductors, or pre-synaptic and post-synaptic components of a physical neural network. Thakoor does refer generally to "neural network architectures" and "synapses" (see page 3132, left column, lines 22-24), but does not provide for any disclosure, teaching or suggestion of nanoconductors, and pre-synaptic and post-synaptic components of a physical neural network. Thakoor only refers generally to "neural network architectures" but does not describe a physical neural network and instead teaches a "memistor" device, which is not a physical neural network as taught by Applicant's invention. Thakoor does not provide any teaching anywhere of nanoconductors and pre-synaptic and post-synaptic components as taught by the Applicant's invention.

The Applicant provides for a teaching of "nanoconductors," which is not taught by Thakoor. For example, the Applicant's specification at paragraph [0020] indicates the following:

> *"Integrated circuits and electrical components thereof, which can be produced at a molecular and nanometer scale, include devices such as carbon nanotubes and nanowires, which essentially are nanoscale conductors ("nanoconductors"). Nanoconductors are tiny conductive tubes (i.e. hollow) or wires (i.e. solid) with a very small size scale (e.g., 0.7 to 300 nanometers in diameter and up to 1mm in length)."*

Similarly, the Applicant's specification at paragraph [0087] indicates the following:

> *"The network of nanoconnections depicted in FIG. 3 can be implemented as a network of molecules, including, for example, nanoconductors. Examples of nanoconductors include devices such as, for example, nanowires, nanotubes, and nanoparticles."*
> *It is thus clear that such nanoconductors are not taught, disclosed or suggested by Thakoor.*
> *Additinally, column 3133, left column, lines 1-14 of Thakoor does not provide for any hint, suggestion or teaching of a learning mechanism and specifically, Hebbian learning. Instead column 3133, left column, lines 1-14 of Thakoor refers generally to H+ ions, tungsten acid and chemical processes involved in the liberation of hydrogen and measurement of resistance. It is unclear how column 3133, left column, lines 1-14 of Thakoor constitutes "Hebbian learning" as taught by Applicant's invention. It is also unclear how column 3133, left column, lines 1-14 of Thakoor discloses Hebbian or anti-Hebbian plasticity.*

Applicant is reminded that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See In re Van Geuns, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

In this argument, Applicant admitted Thakoor teaches "synapses" and a "memistor device". In the broadest reasonable interpretation of this art, a memistor device is interpreted as a physical neural network and pre-synaptic and post-synaptic components are inherent in synapses.

As far as Applicant's claim for "**nanoconductors**" is concerned, the prior art anticipates this feature with **H+ ions**, which are clearly measurable and verifiable to be on the nanometer scale. Applicant has not brought **evidence** to prove that H+ ions are not on the nanometer scale, as Examiner asserts.

The "nanoconductors" in Thakoor are "H+ ions" as Applicant calls them (or "H+ ions" as the prior art calls them).

Regarding Applicant's claim for "**Hebbian learning**", Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put a field

to adjust the memory. Such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. Hebbian learning.

As far as Applicant's claim for "**Hebbian plasticity**" or "**anti-Hebbian plasticity**" is concerned, the prior art anticipates this feature in Figure 2. Figure 2 illustrates the variation in resistance with time for several different control voltages. Plasticity by definition is the ability to develop or adapt in response to the environment. Another word, the ability to learn or unlearn. As responded above regarding Hebbian learning, the growing or lessening the conductivity of the resistance put a field to adjust the memory. Therefore, the learning or unlearning is being performed.

Therefore, Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 9

> ***Regarding claim 13 and claim 14**, page 3133, left column, lines 4-5 of Thakoor does not teach, disclose or suggest "nanowires" or "nanoparticles" as taught by Applicant's claim 9 and 10. Instead, page 3133, left column, lines 4-5 of Thakoor indicates only that "the rate of formation of H_xWO_3 depends primarily on the control voltage". H_xWO_3 is a chemical compound, but not a nanowire or a nanoparticle as taguth by Applicant's claim 9 and 10.*

In this argument, Applicant freely admitted that H_xWO_3 is a chemical compound. Nanowires or nanoparticles by definition, are components of nanotechnology to create electrical circuits out of chemical compounds that are capable of being formed into extremely small circuits.

Therefore, Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 10

***Regarding claim 15**, page 3133, left column, lines 1-4 of Thakoor refers generally to "an electric field that drives H+ ions from Cr_2O_3 toward the cathodic WO_3" and to the "injection of H+ ions (protons)" and so forth, but not provide for a disclosure and/or teaching of nanoconductors disposed within a dielectric medium used for creating a physical neural network and wherein such a dielectric medium comprises a dielectric liquid. As indicated earlier, Thakoor does not disclose, suggest and/or teach nanoconductors as taught by Applicant's invention.*
Thakoor does not disclose, suggest or teach a dielectric liquid as taught by Applicant's amended claim 15. The Applicant has amended claim 15 to further define the dielectric medium as constituting a dielectric liquid. It is believed that support for this amendment is provided and enabled by Applicant's specification. For example, paragraph [00106] of Applicant's specification teaches a "dielectric medium (e.g., a dielectric solvent or dielectric solution)". Paragraph [00106] of Applicant's specification also refers to "a solution of nano-conductors and a dielectric medium (e.g., a dielectric solvent)". Page 3133, left column, lines 1-4 of Thakoor does not provide for a teaching of a dielectric liquid as taught by Applicant's amended claim 15.

The "nanoconductors" in Thakoor are "H+ ions" as Applicant calls them (or "H+ ions" as the prior art calls them). They are suspended in a "**thin film of hygroscopic chromium trioxide**" as the prior art calls it (or "dielectric medium" as Applicant calls it). Hygroscopic by definition means a substance that attracts and retains water. Therefore, Thakoor anticipates Applicant's claim 15.

Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 11

***Regarding claim 16**, Thakoor does not disclose all of the following claim limitations of Applicant's claim 16: nanoconductors that form physical neural connections, the dielectric medium exposed to an electric field, and physical neural connections that can be strengthened or weakened depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof. Instead, page 3133, left column, lines 1-14 of Thakoor refers generally to an electric field that drives H+ ions from Cr_2O_3 toward the cathodic WO_3" and to the "injection of H+ ions (protons)" and so forth, but does not provide*

for a disclosure and/or teaching of nanoconductors disposed within a dielectric medium used for creating a physical neural network. There is also no disclosure here of neural connections and the strengthening or weakening of such neural connections.

As far as Applicant's claim for "**nanoconductors**" is concerned, the prior art anticipates this feature with **H+ ions**, which are clearly measurable and verifiable to be on the nanometer scale. Applicant has not brought **evidence** to prove that H+ ions are not on the nanometer scale, as Examiner asserts.

The "nanoconductors" in Thakoor are "H+ ions" as Applicant calls them (or "H+ ions" as the prior art calls them). They are suspended in a "**thin film of hygroscopic chromium trioxide**" as the prior art calls it (or "dielectric medium" as Applicant calls it).

Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put an electric field to adjust the memory. Such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. Hebbian learning, which is a neural connection.

Therefore, Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 12

***Regarding claim 17 and claim 18**, page 3133, left column, lines 1-14 of Thakoor does not disclose a "dielectric medium comprising a dielectric solvent or a dielectric solution" as taught by Applicant's amended claim 17. Thakoor at page 3132, left column, lines 24-41 and page 3133, left column, lines 1-14 also does not make any mention of neural connections formed when the dielectric medium is exposed an electric field. Where are such neural connections disclosed by page 3132, left column, lines 24-41 and page 3133, left column, lines 1-14 of Thakoor? Additionally, Thakoor at page 3132, left column, lines 24-41 and page 3133, left column, lines 1-14 also does not disclose that the physical neural connections can be strengthened or weakened*

depending upon a strengthening or weakening of said electric field or an alteration of a frequency thereof.

The "nanoconductors" in Thakoor are "H+ ions" as Applicant calls them (or "H+ ions" as the prior art calls them). They are suspended in a "**thin film of hygroscopic chromium trioxide**" as the prior art calls it (or "dielectric medium" as Applicant calls it). The dielectric solvent is disclosed as a "hygroscopic i.e. moisture film" in Thakoor.

Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put an electric field to adjust the memory. Such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. Hebbian learning, which is a neural connection.

Therefore, Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 13

***Regarding claim 19**, Figure 2 of Thakoor does not describe a learning mechanism as taught by Applicant's invention, and also does not provide for any teaching whatsoever of "Hebbian learning" as taught by Applicant's invention. Instead, Figure 2 of Thakoor only illustrates a graph of resistance versus time (in minutes), and programming characteristics based on resistance versus time with respect to various voltages. This is not a learning mechanism or Hebbian learning as taught by Applicant's claim 19. Figure 2 also does not disclose Hebbian or anti-Hebbian plasticity as taught by Applicant's claim 19.*

Regarding Applicant's claim for "**Hebbian learning**", Thakoor on page 3133, left column, lines 1-14 teaches the growing or lessening the conductivity of the resistance put a field to adjust the memory. Regardless of whether Applicant agrees, such teaching, to one of ordinary skill in the art, can clearly be a learning mechanism i.e. Hebbian learning.

As far as Applicant's claim for "**Hebbian plasticity**" or "**anti-Hebbian plasticity**" is concerned, the prior art anticipates this feature in Figure 2. Figure 2 illustrates the variation in resistance with time for several different control voltages. Plasticity by definition is the ability to develop or adapt in response to the environment. Another word, the ability to learn or unlearn. As responded above regarding Hebbian learning, the growing or lessening the conductivity of the resistance put a field to adjust the memory. Therefore, the learning or unlearning is being performed.

Applicant's argument is unpersuasive on these points and the rejections STAND.

Argument 14

***Regarding claim 20**, Figure 3 of Thakoor does not illustrate an integrated circuit chip. Figure 3 also provides for no teaching of nanotechnology.*

Applicant's argument is merely a general denial of the rejection and does not address the components pointed out by the Examiner. Figure 3 clearly indicates "a circuit utilizing a WO_3, thin-film memistor."

As responded above, the "nanoconductors" in Thakoor are "H+ ions" as Applicant calls them (or "H+ ions" as the prior art calls them). Therefore, Figure 3 anticipates Applicant's claim of an integrated circuit chip utilizing nanotechnology.

Applicant's argument is unpersuasive on these points and the rejections STAND.

2. Rejection of claims 8 and 12 under 35 U.S.C. § 103(a)

Argument 15

The Thakoor reference does not disclose all of the claim limitations of the claims from which claims 8 and 12 depend, Thakoor cannot properly be combined with Srivastava as a basis for a rejection to claims 8 and 12 under 35 U.S.C. 103.
Srivastava does not provide for any teaching of neural networks nor any hint or suggestion of how the nanotubes or fullerenes described in the Srivastana could be adapted for use with a physical neural network as taught by Applicant's claims 8 and 12. Instead, page 52, left column, lines 3-11 merely refers to a "biological neural network" but does not indicate how a carbon nanotube could be adapted for use in the physical neural network taught by Applicant's claims 8 and 12. Additionally, as indicated above, Thakoor does not describe a physical neural network as taught by Applicant's claims 8 and 12. Thus, there is no motivation for combining Srivastava and Thakoor as argued by the Office Action to derive all of the claim limitations of Applicant's claims 8 and 12.
The Applicant submits that the rejection to claims 8 and 12 fails under all three prongs of the aforementioned prima facie obviousness test. First, there is no suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine the reference teachings as suggested by the Office Action. Second, the Office Action has not provided an explanation of a "reasonable expectation of success" for such a combination, given that Srivastava provides absolutely no teaching of neural networks and neural network components, and Thakoor does not teach all of the claim limitations of Applicant's claims 8 and 12 and the claims from which such claims depend. Third, Srivastava and Thakoor when combined do not provide for the teaching or suggestion of all the claim limitations of Applicant's claims 8 and 12.

In response to this argument, Applicant is reminded that the Thakoor reference teaches all of the claim limitations of the claims from which claims 8 and 12 depend (see above Examiner's response). Therefore, Thakoor is properly combined with Srivastava as a basis for a rejection to claims 8 and 12 under 35 U.S.C. 103. Moreover, Thakoor and Srivastava when combined provide all the claim limitations of Applicant's claims 8 and 12.

Applicant is directed to page 10 above of the Office Action where the teaching or suggestion to make the combination cited is found **within the prior art itself.**

Regarding Applicant's argument that the Office Action has not provided an explanation of a "reasonable expectation of success". M.P.E.P. 2143 does not require the Examiner provided

an explanation but instead "Applicants may present evidence showing there was not reasonable expectation of success."

On this basis, applican'ts argument is found unpersuasive. Therefore, the rejections of the claims STAND.

CONCLUSION

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

CORRESPONDENCE INFORMATION

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mai T. Tran whose telephone number is (571) 272-4238. The examiner can normally be reached on M-F 9:00am-- 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Vincent can be reached on 571-272-3080. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

M.T.T
Patent Examiner

10/30/06
David Vincent
Supervisory Patent Examiner
Tech Center 2100